Handout at Eng. Conf
10/21/96

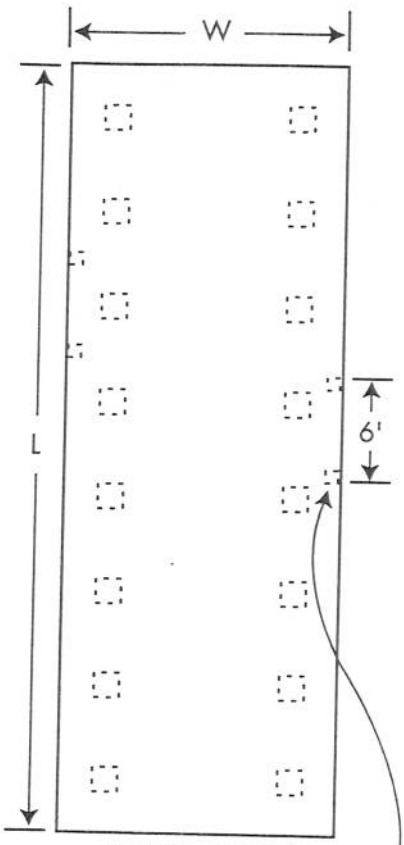
NOTES:

1. In flood hazard areas, footings may be subject to scour. The depth to which footings and anchors must be lowered is to be determined by the local jurisdiction unless an engineered design is provided that accounts for the flow velocities and soil types at the site. Flows as low as 1 foot per second can scour to a depth of 2 feet; flows moving at 10 feet per second can scour to a depth of 4 feet. Footings and anchors must be lowered accordingly (see Figure 7).

2. Any foundation that includes a pier higher than 72 inches or any foundation in which more than 20 percent of the piers exceed 40 inches in height must be approved by a licensed architect or engineer. (Refer to Washington Administrative Code 296-150B-235.)

3. Piers consisting of blocks stacked up to three high can be constructed from a single course of dry-stacked blocks; four- and five-block-high piers must be constructed of a double course of blocks; piers over five blocks high must be constructed of a double course of blocks in which the block cells are grouted with 2,000-pounds-per-square-inch concrete or mortar. (Refer to Washington Administrative Code 296-150B-235.)

4. Anchor tiedowns are required at each chassis beam and at each end of each transportable section of the manufactured home (see Figures 2, 9, 10, and 11 for detailed information).



TYPICAL PIER/
FOOTING LAYOUT

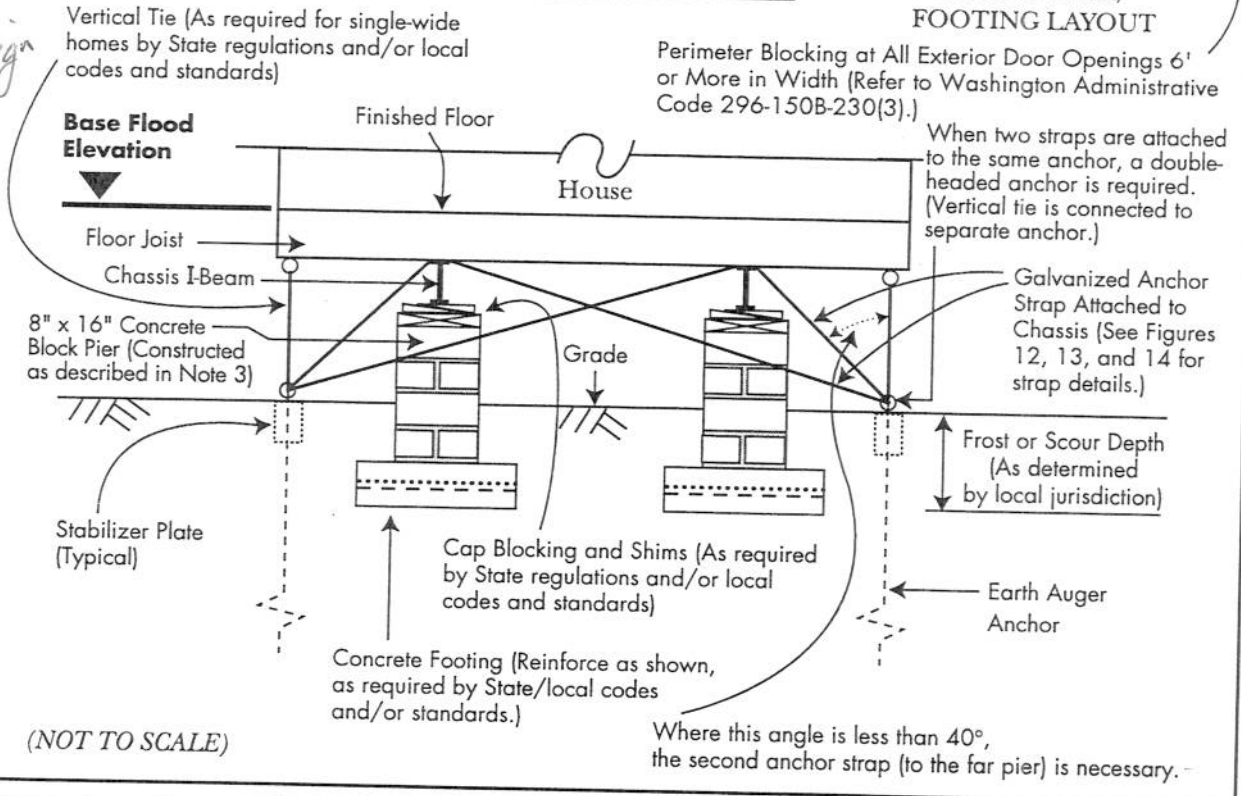


Figure 4a. Concrete block piers on concrete footings, with earth auger anchors. (Single-wide home.)

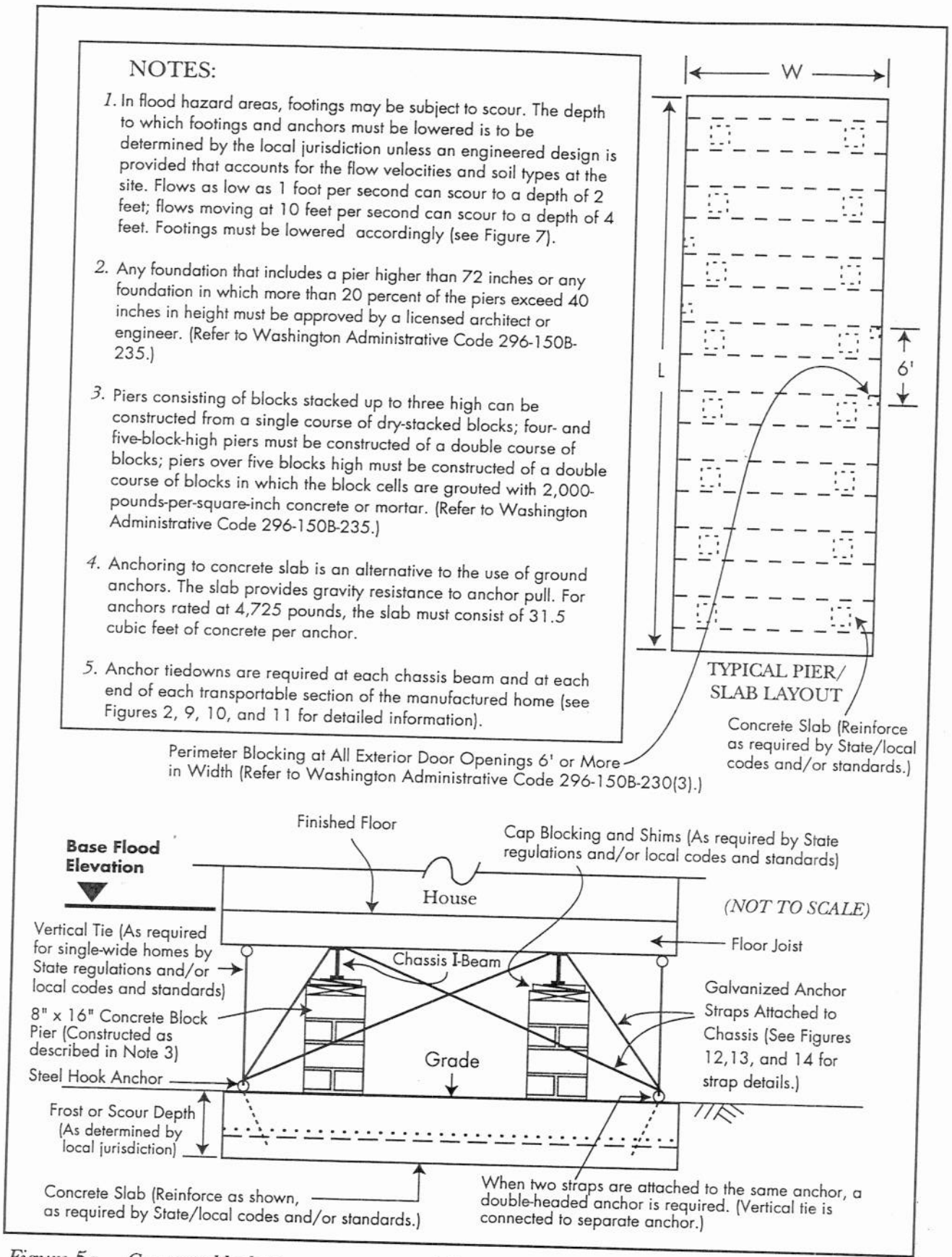


Figure 5a. Concrete block piers on concrete slab, with steel hook anchors. (Single-wide home.)

DETERMINING SOIL CONDITIONS AND SELECTING ANCHOR TYPE

A soil test probe is used to determine the soil conditions below the surface of the ground, near the anchor's helical plate. Maximum anchor holding strength is ensured by choosing an anchor of the proper type for the identified soil conditions.

INSTRUCTIONS

1. Place the tip of the probe into the ground where you intend to place an anchor. Using an electric drive machine, rotate the probe in a clockwise direction.
2. Drive (rotate) the probe into the soil to a depth equal to the length of the anchor rod, starting at 30 inches.
3. To determine the soil classification:
   - Attach a torque wrench to the probe.
   - Rotate the probe steadily with the wrench while supporting the probe shaft with one hand. (DO NOT EXCEED 600 POUND-INCHES.)
   - Read the torque wrench while rotating the probe clockwise.
   - Use the soil classification chart (below) to interpret probe readings and determine the proper type of anchor.
4. Remove the probe with the electric drive machine in reverse (counter-clockwise).
5. Install the proper anchor in the test hole.

SOIL CLASSIFICATION CHART

Soil Class	Soil Classification	Test Value (In Pound-Inches)	Recommended Anchors
1	Sound hard rock	Not Applicable	Cross-Drive Rock Anchor
2	Very dense and/or cemented sands, coarse gravel/cobbles, preloaded silts, clays, and coral	550	30", 5/8" diameter rod, 2" - 4" earth auger 30", 3/4" diameter rod, 2" - 4" earth auger 48", 5/8" diameter rod, 1" - 6" earth auger 48", 3/4" diameter rod, 1" - 6" earth auger
3	Medium–dense coarse sands, sandy gravels, very stiff silts, and clays	350 to 550	48", 5/8" diameter rod, 1" - 6" earth auger 48", 3/4" diameter rod, 1" - 6" earth auger 36", 5/8" diameter rod, 1" - 6" earth auger
4	Loose to medium–dense sands, firm to stiff clays and silts, alluvial fill	200 to 350*	48", 5/8" diameter rod, 1" - 6" earth auger 48", 3/4" diameter rod, 1" - 6" earth auger

*When soil test values are below 200 pound-inches, a professional engineer should be consulted.

Figure 8. Soil testing and anchor selection.

DESIGN LOADS:

Wind	15-25 Pounds Per Square Foot (80-110 Miles Per Hour)
Soil Bearing	1,000 Pounds Per Square Foot
Tiedown Straps	3,150 Pounds Working Load
Seismic Zone	3

Tiedown straps must be a minimum of 1 1/4 inch wide with 0.035-inch thickness zinc plating and meet Federal Specification QQ-S-781H For Type 1, Class B, Grade 1 strapping.

Earth Augers	2,962 Pounds (Tested To 4,750 Minimum)
Cross-drive Anchors	1,727 Pounds (Calculated)
Concrete Slab Anchors	1,390 Pounds (Calculated)

GENERAL NOTES:

1. The charts shown in Figures 10 and 11 are for the required number of tiedowns on the sides of the manufactured home.

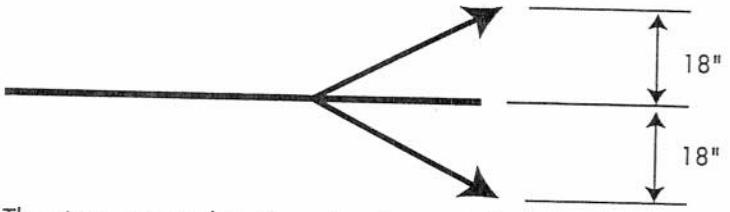
2. Tiedowns are required at each chassis beam and at each end of each transportable section of the manufactured home; they can be of any of the types shown herein.

3. Combinations of the different types of the tiedowns can be used.

4. In the event an earth auger anchor cannot be installed because of an obstruction, use of cross-drive anchors is permitted, provided two cross-drives are installed for each earth auger that cannot be installed.

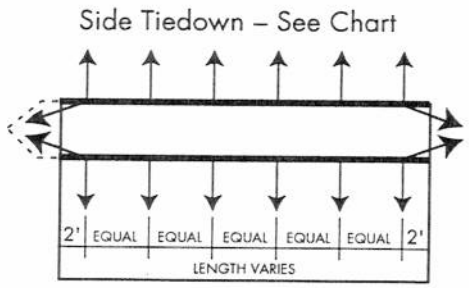
5. For convenience, most of the chassis beams illustrated herein are shown as I-beams. However, chassis beams can also be C-shaped or RFC-shaped (see Figures 12,13, and 14.

6. Washington State includes areas in Seismic Zones 2B and 3 (International Conference of Building Officials, *Uniform Building Code*, Vol.2, 1994.). The Washington Administrative Code, Section 296-150-200(5), states that local jurisdictions may set requirements necessary to lessen the earthquake hazard. Therefore, the homeowner or installer should check with local officials to determine whether such requirements have been established. At a minimum, however, end tiedowns should be installed at the end of each chassis beam. End tiedowns can be located within 18 inches of either side of the chassis beam axis as shown below:

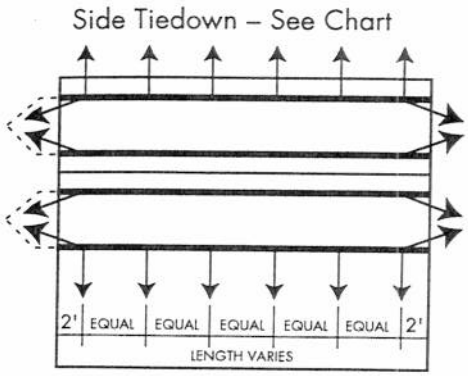


7. The sizes, types, lengths, etc. of materials shown herein are minimums. Larger, longer, heavier materials supplied by anchor system manufacturers may be used at the same spacing and locations shown.

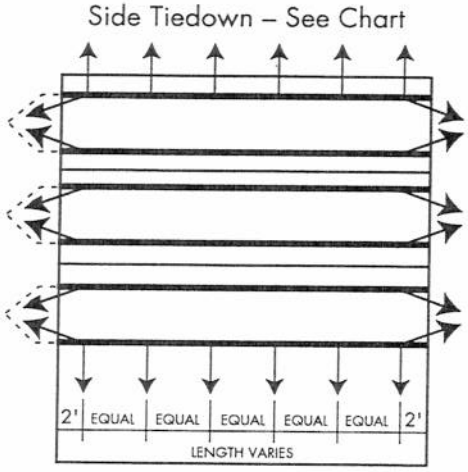
Figure 9. Design loads and general notes.



SINGLE–WIDE



DOUBLE–WIDE



TRIPLE–WIDE

NOTE:
End tiedown requirements are covered in Figure 9.

EARTH AUGERS					
Maximum Length of Manufactured Home	36'	54'	72'		
Minimum Number of Side Tiedowns per Side*	2	3	4		

CROSS–DRIVE ANCHORS					
Maximum Length of Manufactured Home	36'	42'	52'	62'	73'
Minimum Number of Side Tiedowns per Side*	3	4	5	6	7

CONCRETE SLAB ANCHORS					
Maximum Length of Manufactured Home	34'	42'	50'	59'	68'
Minimum Number of Side Tiedowns per Side*	4	5	6	7	8

* Same for single-, double-, and triple-wide homes

Figure 10. Tiedown requirements for homes elevated up to 3 feet in areas subject to wind pressure of 15 pounds per square foot.